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## Research Journal of Human and Social Aspects

Web link: <https://rjhsa.cclll.org>

P-ISSN: [3006-9696](https://doi.org/10.71085/rjhsa.04.04.140), E-ISSN: [3006-970X](https://doi.org/10.71085/rjhsa.04.04.140)

Volume 4 Issue 4, 2026, Page Rang: 98-109



### Effect of Digital Technology and Leadership Competencies on Students' Engagement at Higher Education Institutions

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#### Article information

##### Article History:

Received: 2026-08-02

Received in revised form:  
2026-09-05

Accepted: 2026-09-15

Published Online: 2026-10-01

##### Keywords:

Artificial Intelligence; Punjab;  
Student Engagement;  
Educational Transformation;  
University teachers.

#### ABSTRACT

In innovative pedagogies supported by Artificial Intelligence (AI) technologies, higher education is experiencing a revolution that reprograms the learning, engagement and contributions of students to social change. With the goal of enhancing learning effectiveness and fostering student-centred learning, various AI-tainted technologies have found their application in modern educational methods, such as intelligent tutoring systems, adaptive learning systems, and automated feedback systems. The study's objective is to measure the effect of teacher's leadership quality, their AI literacy and use of AI in teaching on their students' engagement in learning. A quantitative survey research design was employed in analysing the data obtained from the university teachers through a questionnaire. A multi stage sampling technique was used to select the respondent faculty members of the study. Data was collected from 250 teaching faculty member's teachers belonging to faculty of social sciences in three public universities of Punjab province. The results showed that AI Literacy, teacher leadership and Use of AI in teaching significantly predict the students' engagement ( $F = 56.51$ ,  $p < .001$ ). Therefore, the study suggests that in order to successfully integrate AI in higher education, it is necessary to train the teachers for integrating AI in pedagogy to enhance students' engagement. Further, Universities need to increase institutional support, continuous faculty development, and AI supported infrastructure, which encourage and promote the use of AI technologies in an effective and ethical manner.



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## Introduction

Digital technologies have advanced in an amazing way, and have affected virtually every facet of society, with all education sectors and higher education not being an exception. The application of technology, digital devices, online learning platforms, and Artificial Intelligence (AI) applications in education has become more common in the modern context of universities around the world. The technological change has created some opportunities to enhance the quality of education, to make learning more interactive and to assist students in being more active in the learning process. Furthermore, digital innovations in education have gained more and more traction in the research and teaching communities, where researchers and teachers are supposed to acquire the skills and competencies necessary to incorporate digital technologies into effective education (Redecker, 2017). The digital technology competencies are the knowledge, skills, attitudes, and abilities needed to effectively use digital technologies in teaching and learning, communication and collaboration, professional development, assessment, and improving teaching and learning. High digital competence in HE could enable faculty members to design learning spaces where students are actively involved and interact with learning materials via meaningful learning experiences. Additionally, the successful implementation of technology in the classroom can improve student engagement, interaction, collaboration, and student learning outcomes (Falloon, 2020).

With the growing presence of digital technologies, however, their effective use doesn't follow. The teaching effectiveness of technology will greatly vary depending on how well faculty are trained, skilled, confident and ready. In the past few years, AI has become one of the most ground breaking technologies in schools. AI is defined as computer systems and applications that can carry out tasks that require human intelligence, including decision making, problem solving, natural language processing, data analysis and making personalised recommendations. AI technologies have been increasingly utilizing in the field of education, such

as intelligent tutoring system, adaptive learning system, virtual assistant, assessment tools, and generative AI applications (Holmes et al., 2019). The technologies can offer individualized learning opportunities, immediate feedback, personalized support and possibly more efficient learning processes. But the learning benefits of using AI cannot be realised by making AI tools available; it requires teachers to make sense of how these tools work, and how they can be used in teaching. The incorporation of AI in the education sector has, therefore, opened new avenues for boosting the outcomes of teaching and learning in higher education. Educational tools, through the use of artificial intelligence, can be employed to examine the learning behaviour of students and detect their learning ability, analyse their strengths and weaknesses, and offer personalized learning courses that can meet the needs of different students. These features aim to improve the learning experience and offer more interactive and engaging learning opportunities. Zawacki-Richter et al. (2019) provide the utilization of AI in higher education, including personalized learning approaches, automatic assessment, and adaptive learning. Similarly, Luckin et al. (2016) have emphasised the ways in which AI technology can assist teachers with making informed decisions and enhance student outcomes. The effective use of AI in higher education, however, relies on faculty members' understanding, assessment, and strategic use of AI-driven tools in their educational settings.

Moreover, although Artificial Intelligence technologies have been evolving and gaining traction in recent times, the efficacy of these technologies is also hugely dependent on skill set and knowledge of college and university faculty members. Thus, digital competence might not be enough in the classrooms today in which a lot of technology is present. Teachers should gain more knowledge on AI, including its concepts, applications, ethical considerations, limitations, and pedagogical applications. Furthermore, those teachers with higher AI knowledge might be more equipped to leverage AI tools for enhancing teaching and learning, as well as designing learning

spaces to engage students' interest and engagement (Ng et al., 2021). Nevertheless, the uneven digital technology competence and understanding of AI among faculty members can affect the effectiveness of their use of these technologies in the classroom. Another key issue in higher education, closely related to student engagement, is learning outcomes. Student outcomes are another key issue in higher education, and is closely related to the student's learning experience. Students' engagement is usually described in terms of students' behavioural, emotional, and cognitive involvement in learning activities (Fredricks et al., 2004). Learners are able to participate actively in classroom activity and the learning process, attempt academic tasks, engage with peers and demonstrate interest and enthusiasm in learning. Furthermore, student engagement has been linked to significant learning outcomes such as student success, retention, satisfaction and academic achievement (Abbas et al. 2020). Consequently, institutions of higher learning have set student engagement as an agenda that they aim to achieve. Ensuring student engagement is difficult, especially in a learning context where students have varying learning needs, motivation and expectations about technology. AI-powered learning systems and other digital tools can be used to support adaptive and interactive learning experiences, provide personalized support, and give learners immediate feedback. These technologies can motivate students to be active participants of learning activities and create learning activities that are more responsive to each student. Additionally, digitally competent teachers might have a better chance of creating innovative and technology-enriched learning experiences to support students with different learning styles and motivate students' critical thinking. Positive correlation between the integration of technology and student engagement has also been demonstrate in educational settings (Bond et al., 2020). The advantages of technology for student engagement, however, are not guarantee, as they can rely on what teachers know about and how they can apply these technologies to teaching.

However, digital transformation is an integral part of the university strategies, but there are still a lot of challenges in the process of preparing faculty members to teach with technology. Previous studies indicate that while some teachers are at an average or acceptable level of digital competence, they might not exhibit the same level of knowledge, confidence, and readiness in the use of various AI technologies in educational settings (Ng et al., 2021). The knowledge and skills gap between general digital competence and the knowledge of AI tools can present difficulties in the effective use of AI tools in teaching and learning. Ethical issues on privacy, data security, responsible use, transparency and appropriate use of AI remain relevant in the discussion of adopting the AI in educational contexts (UNESCO, 2021). This makes it essential that faculty members possess technical expertise as well as understanding and awareness to effectively and responsibly leverage AI in educational environments. As digital transformation and the need for digital and AI skills gain traction in higher education, it is crucial to understand the connection between faculty digital technology competencies, AI knowledge, and student engagement. Exploring these relationships can make an important contribution to higher education institutions, educational leaders, and policymakers who aim to build faculty capacity and gain the educational benefits of emerging technologies. Additionally, knowing the relationship between faculty competencies and the knowledge of AI can give valuable insights for creating faculty professional learning programs, institutional policies, faculty training for AI application, and technology-enriched pedagogy. This awareness can be instrumental in helping institutions develop learning spaces where technology is not left to chance, but serves a specific purpose to enhance students' engagement and learning. With the advent of digital technologies and Artificial Intelligence (AI), higher education has thus been greatly impacted, reshaping the landscape of education within universities. Universities are developing digital learning infrastructure, online learning platforms and new teaching technologies such as AI-assisted learning tools to enhance the learning experience and

academic achievement of students, supporting this transformation. Furthermore, universities are making efforts to build digital learning spaces with accessibility, flexibility, interaction and personalized learning. However, the contribution of these technological advances to teaching and learning largely hinges on how university faculty members can learn to comprehend and use digital technologies and AI applications in their teaching.

While AI holds promise for enhancing educational products, processes, and learning experiences, research suggests that the digital competence and understanding of AI among University faculty members can vary greatly. Potential use of digital and AI technologies to facilitate active learning and engagement may be effective for some teachers, while not so for others, who could face challenges related to skills, training, awareness, or hands-on experience. Moreover, the competences of faculty members can have an impact on the quality of technology-enhancing teaching as well as the extent of student engagement in learning activities. As a result, student engagement in higher education continues to be a crucial issue because it is link to academic achievement and a variety of other educational outcomes such as achievement, satisfaction, and retention. While there is some previous research that has studied digital technology integration and the use of Artificial Intelligence (AI) in education, they have generally been studied separately. Yet, studies that explore the interactive effect of faculty digital competence and AI knowledge on student engagement in higher education are still needed. In addition, the existing literature has tended to concentrate mainly on technologies and their uses, instead of on the skills and knowledge of the faculty members who are in charge of introducing the technologies. Thus, an analysis of faculty digital technology competencies and knowledge of AI as antecedents of student engagement can offer a more complete picture of the role that these factors may play in the meaningful technology-enhanced learning experience in higher education.

## Literature Review

Today one of the most transformative technologies are AI based that are transforming the higher education. These are impacting teaching & learning, assessment, and educational management are Intelligent Tutoring Systems, Adaptive Learning platforms, automated grading systems, Predictive Analytics, and Chatbots have been introduced in university environments worldwide in today's digital world. All the technological developments have given great opportunities to enhance the participation of students, personalization of learning, and learning efficiency in Higher Education Institutions (HEIs) (Zawacki-Richter et al., 2019; Holmes et al., 2022). But the adoption of AI in the education sector is not merely a technological advancement, it's a transformative shift in the way teaching and learning could take place.

The use of AI-driven systems can process vast amounts of student data to uncover patterns in learning, identify strengths and challenges, and offer real-time feedback to students and educators. This data-driven approach can enable teachers to make decisions that are more informed and be more responsive to teaching. Additionally, in the higher education sector, AI applications are designed to enhance learning experiences and outcomes by tailoring learning paths to match student needs, adapting materials to individual learning styles, and offering ongoing support for learning. AI can aid in creating adaptive learning paths that allow for instruction tailored to the learning needs of each student, potentially improving student engagement and success in learning. Furthermore, with these systems, cognitive load can be decreased by dividing the content into smaller learning contexts, making learning material easier to understand and process for students. One of the key developments that AI could enable in higher education is personalized learning. Personalized learning involves teaching methods that cater to the needs, interests, capabilities and learning rates of each student. At its core, the personalization relies on the ability of AI systems to monitor students' performance continuously and offer specific recommendations

for improvement tailored to each student. AI based learning programs can help students achieve a level of autonomy that enables them to learn at their own speed without the need for any external supervision, while providing them with constant feedback, argue Holmes et al. (2022). However, having AI-based systems is not enough; there is a need for suitable pedagogical planning and teachers who know how to use these effectively to achieve personalized learning.

One of the key aspects of this process is self-regulated learning, which requires students to plan, monitor and evaluate their own learning. With AI technologies such as Intelligent Tutoring Systems (ITS) and learning analytics dashboards, students can monitor their progress and identify areas that require improvement. Luckin et al. (2016) note that metacognition can be promoted by AI technologies, such as prompting students to consider their learning process and adjust it according to the reflection on the learning process by referring to information and feedback. Moreover, this new level of independence can help enhance students' thinking engagement and learning achievement. The effectiveness of these benefits will rely on the appropriate use of AI technologies in instructional and learning processes, however. It is well established that engagement of learners in higher education (HE) is important on many fronts. Student engagement is usually defined as students' behavioural, emotional and cognitive participation in learning tasks (Fredricks et al., 2004). In recent years, digitalization has been playing an increasing role when it comes to supporting student engagement in the learning environment. When engaging students in the learning process, AI-based learning environments have brought about new ways of engaging students through gamification, interactive content, adaptive feedback mechanisms, and personalized learning experiences (Khalil & Ebner, 2023). Studies on AI-aided learning have shown that it is beneficial for student motivation, engagement, and satisfaction. These advances will not only facilitate personal learning, but also have implications for the development of AI based personalized learning

systems and for the development of more social and participatory learning environments. However, the impact of these methods is contingent on the proper usage and selection of AI tools in the educational environment.

Beyond reshaping students' learning experiences, AI is also impacting the job duties and roles of university faculty. In addition to student-centered outcomes, there has been greater focus on how AI is impacting University teachers' work. As part of this new higher education context, teachers are asked to play several roles, such as knowledge sharers, facilitators, instructional designers, learning analysts and knowledge transmitters. Furthermore, AI technologies could help teachers with repetitive tasks like marking assignments, analysing student performance, preparing reports and giving feedback for learning and teaching (Chen et al., 2023). This shift could enable teachers to focus more on pedagogical innovation, planning, pedagogical support, and pedagogical practice with a focus on placing the learner in the center of the educational process. But faculty preparation and competencies play a significant role in the effective use of these technologies.

Thus, the skills of the faculty, especially in terms of digital technology skills and knowledge of AI, are crucial in shaping the success or failure of AI integration in higher education. Digital technology competencies are defined as knowledge, skills and attitudes needed to use digital technologies effectively in teaching, communication, assessment, collaboration, and enhancing learning outcomes. Higher levels of faculty digital competency are linked to innovative pedagogical use and effective use of technology in classrooms and creating meaningful learning environments (Falloo, 2020; Redecker, 2021). Moreover, digitally competent teachers might be better equipped to choose the right technology, incorporate it in the school's teaching practices, and utilize digital resources as tools to facilitate student learning and participation.

However, the effective use of digital technologies may not be possible in all situations by many teachers due to a lack of training, institutional

support, and real-world practice. AI technologies in higher education are becoming more popular, making this a critical issue. AI knowledge encompasses what teachers know about AI concepts, uses, constraints, ethical issues, and educational impacts. Faculty members, however, do not necessarily have the required knowledge to use AI tools effectively and responsibly. The lack of knowledge and understanding can pose difficulties in the effective integration of AI into education. Lack of AI knowledge can make it challenging for teachers to use the right AI tools, understand the meaning of AI-generated content, assess whether AI-generated content is accurate, and create AI-informed learning experiences. Moreover, a lack of understanding regarding ethical concerns, privacy, data security and the responsible use of AI could pose further obstacles in faculty adoption and implementation. This can hinder the full realization of the value of AI to enhance student engagement, learning experiences, and educational outcomes. Thus, upskilling faculty members' digital skills and understanding of AI is crucial to facilitate meaningful, responsible and pedagogically appropriate integration of AI in higher education.

AI has also become increasingly connected with the development of new pedagogical approaches in higher education. Some of the common learning models are a Flipped classroom, Blended learning, Gamified learning, and Project-based learning. Such pedagogies can be further enriched through AI functionalities such as instant feedback, adaptive learning pathways, personalized support, and customized teaching assistance. In 2019, Zawacki-Richter et al. carried out a systematic literature review on AI applications in higher education and emphasized how successful the use of AI was strongly related to pedagogical design. That is, technology should augment, not supplant, the use of suitable pedagogical approaches. AI technology is useless if it isn't being used effectively

as a pedagogical tool. Furthermore, while there is great potential in using AI tools to enhance teaching and learning, some educators may lack the necessary expertise and understanding to leverage these tools in their professional practice. Therefore, this study is aimed at measuring the prediction of students' engagement through teachers' leadership style, AI literacy and AI use in teaching.

### Research Methodology

Using a quantitative research approach, the research investigated the relationships between digital literacy, teacher leadership, AI's use in teaching, and student engagement. The quantitative approach to the study was to gather the numerical data of the study variables and statistical analysis of the data was done to find out the relationship between the different variables. The sample of 250 university teachers was by multistage sampling technique from the public sector universities. The participants comprised different departments of Social Sciences such as Education, Psychology, Social Work, Sociology, Political Science and History. Data were gathered on the major variables of the present study by means of a well-structured questionnaire with five-points Likert scale. After reading the relevant literature and discussion with research supervisor, the research instrument was developed. Items were taken from the Technology Acceptance Model (TAM) by Davis (1989), and adapted and created to measure constructs and objectives specific for this study. The collected data were analyzed using the descriptive and inferential statistics.

### Results

The following frequency distribution in table 1 presents the demographic profile of the respondents.

**Table 1:** *Frequency Distribution of Demographic profile of Respondents*

| Variables                | Frequency | Percentage |
|--------------------------|-----------|------------|
| <b>Gender</b>            |           |            |
| Male                     | 130       | 52%        |
| Female                   | 120       | 48%        |
| <b>Designation</b>       |           |            |
| Lecturer                 | 69        | 27.6%      |
| Assistant Professor      | 143       | 57.2%      |
| Associate Professor      | 21        | 8.4%       |
| Professor                | 17        | 6.8%       |
| <b>University Type</b>   |           |            |
| <b>Public</b>            | 250       | 100%       |
| University of Sargodha   | 90        | 36%        |
| University of Panjab     | 87        | 34%        |
| GC University Faisalabad | 73        | 29%        |
| <b>Qualification</b>     |           |            |
| MS/M Phil                | 26        | 10.4%      |
| PhD National             | 120       | 48.0%      |
| PhD International        | 85        | 34.0%      |
| Post Doctorate           | 19        | 7.6%       |

The frequency distribution shows that 250 respondents were evenly gendered, with 130 men (52%) and 120 women (48%). Concerning designation, majority of them were Assistant Professors (57.2%), followed by Lecturers (27.6%), Associate Professors (8.4%) and Professors (6.8%). This suggests that Assistant Professors were the largest group of participants might give some context to the study of faculty digital literacy, faculty leadership, and the use of AI in education. Out of total participants, 36% were affiliated with the University of Sargodha, 34% with University of the Punjab and 29 % GC University Faisalabad. Representatives of each of the public universities were invited to represent a broader institutional context for understanding the

study variables. Regarding qualification, 48% of the respondents possessed National PhD, 34% international PhD, 10.4% MS/MPhil and 7.6% Post Doctorate. The large percentage of doctoral qualified respondents may be of relevance to their encounters with digital technologies, leadership practices and AI-based teaching as those with higher academic qualifications are likely to have encountered and used these more. In general, the profile shows that the sample was composed primarily of academic qualified staff working in public sector universities. The characteristics give context to the issues of digital literacy, teacher leadership, the use of AI in teaching and student engagement.

**Table 2:** Mean, Standard Deviation, and Correlation Coefficients of the Study Variables

| Variables           | N   | Mean   | Std. Deviation | 1       | 2       | 3       | 4 |
|---------------------|-----|--------|----------------|---------|---------|---------|---|
| Digital literacy    | 250 | 4.1952 | 0.51700        | —       |         |         |   |
| Teacher leadership  | 250 | 4.0896 | 0.61908        | .437*** | —       | —       |   |
| Use of AI           | 25  | 4.2680 | 0.53325        | .441*** | .528*** |         |   |
| Students Engagement | 250 | 4.2496 | 0.47805        | .431*** | .591*** | .478*** | — |

**Note.** \*\*\* $p < .001$ , \*\* $p < .01$  & \* $p < .05$

Descriptive statistics and the correlation between the four study variables are shown in Table 2. Digital literacy scale had a mean of 4.20 (SD = 0.52), teacher leadership had a mean of 4.09 (SD = 0.62), use of AI had a mean of 4.27 (SD = 0.53), and student engagement had a mean of 4.25 (SD = 0.48). The relatively high mean scores reflect high levels of digital literacy, leadership of teacher, AI use and engagement among respondents. The correlation indicates that there is a significant positive correlation between digital literacy and teacher leadership ( $r = .437, p < .01$ ). Digital literacy was also significantly positively correlated with the use of AI ( $r = .441, p < .01$ ) and student engagement ( $r = .431, p < .01$ ). There was indeed a positive relationship between teacher leadership and the use of AI ( $r = .528, p < .01$ ), and student engagement ( $r = .591, p < .01$ ). Likewise, student engagement was positively related with the use of AI ( $r = .478, p < .01$ ). Overall, the results suggest that there is a positive correlation between increased student engagement and increased levels of digital literacy, teacher leadership, and use of AI. The strongest correlation reported was between teacher leadership and student engagement ( $r = .591^{***}$ ), and moderate and positive was reported between

digital literacy and student engagement ( $r = .431^{***}$ ). The results of these findings indicate significant relationship between these study variables; however, correlation does not imply causation, therefore regression analysis was computed.

### Regression Analysis Results

A multiple regression analysis was used to determine if the variables of Digital Literacy (DL), Teacher Leadership (TL), and Use of Artificial Intelligence (AI) predicted Student Engagement (SE). The ANOVA result revealed that the regression model was significant  $F = 56.51, p < .001$ , suggesting that the three predictors as a whole significantly predicted Student Engagement. In addition, the model yielded a moderate correlation between the predictors and the criterion ( $R = .639$ ) as indicated in the model summary. Furthermore, the  $R^2$  value of .408 showed that 40.8% of the variance in Student Engagement was predicted by Digital Literacy, Teacher Leadership, and Use of AI. The adjusted  $R^2$  was .401, which means that 40.1% of the variance was explained, while adjusting for the number of predictors in the model.

**Table 3: Coefficients**

| Coefficients <sup>a</sup> |           | Unstandardized Coefficients |            | Standardized Coefficients |       |      |
|---------------------------|-----------|-----------------------------|------------|---------------------------|-------|------|
|                           |           | B                           | Std. Error | Beta                      | t     | Sig. |
| 1                         | (Constant | 7.874                       | 1.133      |                           | 6.952 | .000 |
|                           | DL        | .154                        | .052       | .167                      | 2.937 | .004 |
|                           | TL        | .326                        | .046       | .423                      | 7.048 | .000 |
|                           | UI        | .163                        | .054       | .182                      | 3.021 | .003 |

a. Dependent Variable: SE

The findings that explored the influences of Digital literacy (DL), Teacher leadership (TL) and AI use (UI) on student engagement (SE). The results indicate that both predictors, including the three, are positively and significantly associated with student engagement. Digital literacy significantly predicts student engagement ( $B = .154, \beta = .167, t = 2.937, p = .004$ ). This means that increased student engagement is correlated with increased digital literacy. Teacher leadership has a positive and significant effect on student engagement ( $B = .326, \beta = .423, t = 7.048, p < .001$ ). The teacher leadership measure has the largest standardized beta coefficient ( $\beta = .423$ ) suggesting it is the strongest predictor of student engagement in this regression model among the three predictors. Similarly, student engagement is strongly predicted using AI in teaching with a  $B = .163, \beta = .182, t = 3.021$ , and a  $p = .003$ , suggesting that the greater the use of AI in teaching, the higher the student engagement. In general, the regression outcomes suggest that digital literacy and teacher leadership, as well as the use of AI, are good positive predictors of student engagement. The three variables all make a significant contribution to the variance in student engagement, and teacher leadership has the highest relative contribution to the model. The overall results are in line with the proposed relationships among the three predictors and the students' engagement.

## Discussion

The results of the present investigation reveal that student engagement can be seen as having a strong positive correlation with digital literacy. The correlation analysis showed that there was a moderate positive correlation between digital literacy and students' engagement ( $r = .431, p < .001$ ). The results indicated that the students with higher level of digital literacy are more engaged in learning activities. Furthermore, the regression results indicated that the variance in students' engagement could be explained by 18.6% ( $R^2 = .186$ ) of the digital literacy. This means that digital literacy is one of the defining characteristics that is correlated with students' participation, interaction, and involvement in the learning process. This positive relationship could be attributed to the fact that digitally literate students are likely to be better equipped to use technology to support learning. They are able to use different online platforms with more confidence, access online learning materials, have more confidence that they can search for information relevant to their learning, communicate with their teacher and classmates, and submit their assignments. These skills can help students to engage in learning activities in class and online more effectively. Digital literacy can also support students in planning, organizing and managing information, address learning related issues, and use digital resources to support their learning needs. This, in turn, can lead to increased

student participation and engagement. This is also in line with the literature highlighting the relevance of digital competencies in Higher Education. Falloon (2020) and Redecker (2021) emphasized the need for acquiring the competencies necessary to employ digital technologies for effective performance in educational contexts. Similarly, with the growing adoption of digital and AI-enabled learning environments, there is an increasing need in students to be able to interact with technology and have confidence in doing so. Once students are familiar with using digital tools, they can have fewer barriers to engaging with learning materials and may be more willing to engage in technology-based activities. In addition, digital literacy can be used as a tool to promote various aspects of student engagement. Behaviourally, a digitally skilled student may be involved more often in learning activities and more effectively complete technology-based tasks. Cognitively speaking, digital skills can assist students in searching for, assessing and using information for learning purposes. Digital literacy also can help in engaging with the teachers and peers online, contributing to students' engagement in learning. Thus, it can be concluding that the positive correlation in this study indicates that digital literacy can be very instrumental in creating more active and participative learning experiences.

The findings, however, also reveal that digital literacy is not the only determinant that affects student engagement. It accounted for 18.6% of the variance, but 81.4% of the variance was not accounted for. This suggests that there are a number of other factors that affect student engagement. The level of motivation of students, the quality of teaching, the learning environment, teacher-student interaction, the availability of learning resources and institutional support can also have an impact on students' engagement. However, digital literacy improvements may not be enough to boost student engagement. The overall results revealed that the digital literacy is an important factor in student involvement in higher education. Students with greater technological competence could be better equipped to access, communicate, participate, and interact in

technology enhanced learning spaces. But this meaningful student engagement must be supported by digital skills, effective teaching practices, supportive learning environments, and suitable institutional resources. The findings of the present study, therefore, emphasize the need to foster students' digital literacy in addition to other factors that facilitate effective and engaging learning experiences.

## Conclusion

It is concluded from the present study that digital literacy is a significant aspect which can contribute to the improvement of the level of student engagement in higher education. The results support empirical evidence that learners with high digital competence are more likely to be involved in learning activities, to interact with learning resources, and to show high level of involvement in learning process. A strong positive correlation between digital literacy and student engagement underscores the importance of digital skills in facilitating student learning in today's technologically advanced classrooms. In addition, the regression analysis showed that digital literacy was a statistically significant predictor of student engagement in learning, and that the better students' digital literacy skills, the more engaged they will be and participate in learning. With the continuing penetration of digital technologies, online learning platforms, and TEI (technology-enhanced instruction) into educational institutions, the need for digital literacy is increasingly highlight. The ability to access, evaluate, manage and use digital information effectively will enable students to adjust to the demands of today's educational environment and to be successful students. While the results of the digital literacy analysis showed that a significant part of student engagement could be accounted for by digital literacy, the results also indicated that digital literacy was not the sole factor determining student engagement; there are other factors, including motivation, self-efficacy, institutional support, teaching quality, and learning environment. Therefore, although digital literacy is a key priority, universities should also consider a whole-of-university approach to maximize student

engagement whilst tackling these complementary factors. The overarching message of the study is the strategic significance of digital literacy in today's Higher Education and the importance of investing in digital skill development programs by educational policy makers, university administration and educators. Through effective training, technologies, and opportunities to acquire digital knowledge and skills, HE institutions can enable students to become more engaged, motivated, and intellectually successful, ready to meet the challenges of the digital age.

### Recommendations

The results of the study showed that having digital literacy and knowledge of the AI can have a strong positive impact on teaching-level activities and faculty satisfaction in universities. Regular training sessions, workshops and hands-on activities for

academics in AI/Tech is, therefore, a desirable path for universities to improve faculty skills. HEIs and policy makers can leverage AI by creating clear guidelines and providing adequate digital infrastructure, technical support, and financial resources to support effective integration, fostering ethical, responsible, and positive utilization. Long-term implications of integrating AI in teaching effectiveness and student learning in various academic fields, may be explored in future studies. Comparative studies with other universities, private and public, are also recommended so contextual differences can be determined. Moreover, the contributions of qualitative and mixed-method research methods can enhance our understanding of the opportunities, challenges, and implications of AI adoption in higher education.

### Declaration of Conflicting Interest

The author declared no potential conflicts of interest with respect to research.

### Funding Statement

No funding is received for this project.

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